

**Amendments to the Claims:**

This listing of claims will replace all prior versions, and listings, of claims in the application:

**Listing of Claims:**

- 1        1. (currently amended) An image processing apparatus having  
2 offset and optical black correction circuit coupled to receive  
3 a control signal having a first and second phase and an  
4 optical black signal from a charge coupled device, comprising:  
5                a. a first circuit to sample the optical black  
6 signal at a predetermined reference voltage, the first circuit  
7 comprises
  - 8                        i. a correlated double sampler,
  - 9                        ii. a first and second programmable gain  
10 amplifier, the first programmable gain amplifier coupled to  
11 the correlated double sampler, [and]
    - 12                        iii. an adder coupled between the first and  
13 second programmable gain amplifiers, [wherein the correction  
14 circuit couples to the adder to add the positive and negative  
15 difference to the optical black signal;] and
    - 16                        iv. an analog-to-digital converter coupled to  
17 the second programmable gain amplifier for converting the  
18 sampled signal into a digital signal;
  - 19                b. a second circuit to correct the optical black  
20 offset coupled to the first circuit, wherein the second  
21 circuit couples between the adder and the second programmable  
22 gain amplifier to add the positive and negative difference to  
23 the optical black signal, the second circuit comprises

24                           i. a reverse programmable gain amplifier  
25 coupled to the analog-to-digital converter to amplify the  
26 optical black level of the digital signal; and  
27                           ii. an integrator coupled to the reverse  
28 programmable gain amplifier to detect the optical black level  
29 of the digital signal; wherein the integrator couples to the  
30 adder.

1 2. (previously presented) The image processing apparatus as  
2 recited in claim 1, wherein the first programmable gain  
3 amplifier comprises

4                           a first and second sampling circuit;  
5                           a differential amplifier having a first and second  
6 input and a first and second output, the first sampling  
7 circuit coupled to the first input, the second sampling  
8 circuit coupled to the second input; and

9                           a first and second feedback circuit, the first  
10 feedback circuit coupled between the first input and the first  
11 output, the second feedback circuit coupled between the second  
12 input and the second output.

1 3. (previously presented) The image processing apparatus as  
2 recited in claim 2, wherein the first sampling circuit  
3 comprises

4                           a first and second sampling switch;  
5                           a first sampling variable capacitor coupled to the  
6 first sampling switch;

7                           a second sampling capacitor coupled to the second  
8 sampling switch;

9                           a third feedback switch coupled between a power  
10 supply providing a common-mode voltage for the image  
11 processing apparatus and the first sampling variable  
12 capacitor; and

13               a fourth feedback switch coupled between a power  
14 supply providing a common-mode voltage for the image  
15 processing apparatus and the second sampling capacitor.

1     4. (previously presented) The image processing apparatus as  
2 recited in claim 3, wherein the first and second sampling  
3 switch closes on the first phase of the control signal and  
4 wherein the third and fourth sampling switch closes on the  
5 second phase of the control signal.

1     5. (previously presented) The image processing apparatus as  
2 recited in claim 3, wherein the second sampling circuit is  
3 equivalent to the first sampling circuit.

1     6. (previously presented) The image processing apparatus as  
2 recited in claim 2, wherein the first feedback circuit  
3 comprises:

4               a first and second feedback switch coupled to a  
5 power supply providing a common-mode voltage for the image  
6 processing apparatus;

7               a feedback capacitor coupled between the first and  
8 second feedback switches; and

9               a third feedback switch coupled between the feedback  
10 capacitor and the first output node of the amplifier, wherein  
11 the first output of the differential amplifier couples to the  
12 adder.

1     7. (previously presented) The image processing apparatus as  
2 recited in claim 6, wherein the first and second sampling  
3 switch closes on the first phase of the control signal,  
4 wherein the third sampling switch closes on the second phase  
5 of the control signal.

1 8. (previously presented) The image processing apparatus as  
2 recited in claim 6, wherein the second feedback circuit is  
3 equivalent to the first feedback circuit.

1 9. (previously presented) The image processing apparatus as  
2 recited in claim 1, wherein the first programmable gain  
3 amplifier comprises:

4           a sampling circuit;  
5           an amplifier having an input and an output, the  
6 sampling circuit coupled to the input; and  
7           a feedback circuit coupled between the input and the  
8 output.

1 10. (previously presented) The image processing apparatus as  
2 recited in claim 9, wherein the sampling circuit comprises:

3           a first and second sampling switch;  
4           a first sampling variable capacitor coupled to the  
5 first sampling switch;  
6           a second sampling capacitor coupled to the second  
7 sampling switch;  
8           a third feedback switch coupled between a power  
9 supply providing a common-mode voltage for the image  
10 processing apparatus and the first sampling variable  
11 capacitor; and  
12           a fourth feedback switch coupled between a power  
13 supply providing a common-mode voltage for the image  
14 processing apparatus and the second sampling capacitor.

1 11. (previously presented) The image processing apparatus as  
2 recited in claim 10, wherein the first and second sampling  
3 switch closes on the first phase of the control signal and  
4 wherein the third and fourth sampling switch closes on the  
5 second phase of the control signal.

1       12. (previously presented) The image processing apparatus as  
2 recited in claim 9, wherein the feedback circuit comprises:

3               a first and second feedback switch coupled to a  
4 power supply providing a common-mode voltage for the image  
5 processing apparatus;

6               a feedback capacitor coupled between the first and  
7 second feedback switches; and

8               a third feedback switch coupled between the feedback  
9 capacitor and the first output node of the amplifier, wherein  
10 the first output of the differential amplifier couples to the  
11 adder.

1       13. (previously presented) The image processing apparatus as  
2 recited in claim 12, wherein the first and second sampling  
3 switch closes on the first phase of the control signal,  
4 wherein the third sampling switch closes on the second phase  
5 of the control signal.

1       14. (currently amended) The image processing apparatus as  
2 recited in claim 1, wherein the second programmable gain  
3 amplifier comprises:

4               a first and second sampling circuit;

5               a differential amplifier having a first and second  
6 input and a first and second output, the first sampling  
7 circuit coupled to the first input, the second sampling  
8 circuit coupled to the second input; and

9               a first and second feedback circuit, the first  
10 feedback circuit coupled between the first input and the first  
11 output, the second feedback circuit coupled between the second  
12 input and the second output.

1       15. (previously presented) The image processing apparatus as  
2       recited in claim 14, wherein the first sampling circuit  
3       comprises:

4                 a first sampling switch;

5                 a sampling variable capacitor coupled to the first  
6       sampling switch; and

7                 a second sampling switch coupled between the  
8       sampling variable capacitor and a power supply providing a  
9       common-mode voltage for the image processing apparatus.

1       16. (previously presented) The image processing apparatus as  
2       recited in claim 15, wherein the first sampling switch closes  
3       on the second phase of the control signal and the second  
4       sampling switch closes on the first phase of the control  
5       signal.

1       17. (previously presented) The image processing apparatus as  
2       recited in claim 14, wherein the second sampling circuit is  
3       equivalent to the first sampling circuit.

1       18. (previously presented) The image processing apparatus as  
2       recited in claim 14, wherein the first feedback circuit  
3       comprises:

4                 a first and second feedback switch coupled to a  
5       power supply providing a common-mode voltage for the image  
6       processing apparatus;

7                 a feedback capacitor coupled between the first and  
8       second feedback switches; and

9                 a third feedback switch coupled between the feedback  
10      capacitor and the first output node of the amplifier, wherein  
11      the first output of the differential amplifier couples to the  
12      adder.

1 19. (currently amended) The image processing apparatus as  
2 recited in claim 18 [14], wherein the first and second  
3 [sampling] feedback switch closes on the first phase of the  
4 control signal, wherein the third [sampling] feedback switch  
5 closes on the second phase of the control signal.

1 20. (previously presented) The image processing apparatus as  
2 recited in claim 14, wherein the second feedback circuit is  
3 equivalent to the first feedback circuit.

1 21. (previously presented) The image processing apparatus as  
2 recited in claim 1, wherein the second programmable gain  
3 amplifier comprises:

4           a sampling circuit;  
5           an amplifier having an input and an output, the  
6 sampling circuit coupled to the input; and  
7           a feedback circuit coupled between the input and the  
8 output.

1 22. (previously presented) The image processing apparatus as  
2 recited in claim 21, wherein the sampling circuit comprises:  
3           a sampling switch; and  
4           a first sampling variable capacitor coupled to the  
5 first sampling switch.

1 23. (previously presented) The image processing apparatus as  
2 recited in claim 22, wherein the sampling switch closes on the  
3 second phase of the control signal.

1           24. The image processing apparatus as recited in claim  
2 21, wherein the feedback circuit comprises:

3               a first and second feedback switch coupled to a  
4 power supply providing a common-mode voltage for the image  
5 processing apparatus;

6               a feedback capacitor coupled between the first and  
7 second feedback switches; and

8               a third feedback switch coupled between the feedback  
9 capacitor and the first output node of the amplifier, wherein  
10 the first output of the differential amplifier couples to the  
11 adder.

1 25. (previously presented) The image processing apparatus as  
2 recited in claim 24, wherein the first and second sampling  
3 switch closes on the first phase of the control signal,  
4 wherein the third sampling switch closes on the second phase  
5 of the control signal.

1 26. (currently amended) An image processing apparatus having  
2 offset and optical black correction circuit coupled to receive  
3 a control signal having a first and second phase and an  
4 optical black signal from a charge coupled device, comprising:

5               a first circuit to sample the optical black signal  
6 at a predetermined reference voltage, the first circuit  
7 comprises:

8               a correlated double sampler,

9               a first and second programmable gain amplifier,  
10 the first programmable gain amplifier coupled to the  
11 correlated double sampler, and

12               an adder coupled between the first and second  
13 programmable gain amplifiers, wherein the correction  
14 circuit couples to the adder to add the positive and  
15 negative difference to the optical black signal;

16               an analog-to-digital converter coupled to the second  
17 programmable gain amplifier for converting the sampled signal  
18 into a digital signal; and

19               a second circuit to correct the optical black offset  
20 coupled to the first circuit, the second circuit comprises:

21               a first and second sampling circuit, [;]

22               a differential amplifier having a first and  
23 second input and a first an second output, the first  
24 sampling circuit coupled to the first input, the second  
25 sampling circuit coupled to the second input, [;] and

26               a first and second feedback circuit, the first  
27 feedback circuit coupled between the first input and the  
28 first output, the second feedback circuit coupled between  
29 the second input and the second output.

1 27. (previously presented) The image processing apparatus as  
2 recited in claim 26, wherein the first sampling circuit  
3 comprises:

4               a first and second sampling switch, the first  
5 sampling switch coupled to a power supply providing a common-  
6 mode voltage for the image processing apparatus, second  
7 sampling switch coupled to a predetermined optical black  
8 value;

9               a third and fourth sampling switch; and

10               a sampling variable capacitor having a first and  
11 second end, the first and third sampling switches coupled to  
12 the first end of the sampling variable capacitor, the second  
13 and fourth switch coupled to the second end of the sampling  
14 variable capacitor.

1 28. (previously presented) The image processing apparatus as  
2 recited in claim 27, wherein the first and fourth sampling  
3 switch closes on the first phase of the control signal,

4 wherein the second and third sampling switch closes on the  
5 second phase of the control signal.

1 29. (previously presented) The image processing apparatus as  
2 recited in claim 26, wherein the second sampling circuit is  
3 equivalent to the first sampling circuit.

1 30. (previously presented) The image processing apparatus as  
2 recited in claim 26, wherein the first feedback circuit  
3 comprises:

4               a feedback capacitor.

1 31. (previously presented) The image processing apparatus as  
2 recited in claim 30, wherein the second feedback circuit is  
3 equivalent to the first feedback circuit.

1 32. (previously presented) An image processing apparatus  
2 having offset and optical black correction circuit coupled to  
3 receive a control signal having a first and second phase and  
4 an optical black signal from a charge coupled device,  
5 comprising:

6               a first circuit to sample the optical black signal  
7 at a predetermined reference voltage, the first circuit  
8 comprises

9               a correlated double sampler,

10              a first and second programmable gain amplifier,  
11 the first programmable gain amplifier coupled to the  
12 correlated double sampler, and

13              an adder coupled between the first and second  
14 programmable gain amplifiers, wherein the correction circuit  
15 couples to the adder to add the positive and negative  
16 difference to the optical black signal;

17               an analog-to-digital converter coupled to the second  
18 programmable gain amplifier for converting the sampled signal  
19 into a digital signal;

20               a second circuit coupled to the first circuit to  
21 correct the optical black offset, the second circuit  
22 comprises:

23               a sampling circuit;

24               an amplifier having an input and an output, the  
25 sampling circuit coupled to the input; and

26               a feedback circuit coupled between the input  
27 and the output, the feedback circuit coupled to the adder.

1     33. (previously presented) The image processing apparatus as  
2 recited in claim 32, wherein the sampling circuit comprises:

3               a first and second sampling switch, the first  
4 sampling switch coupled to a power supply providing a common-  
5 mode voltage for the image processing apparatus, second  
6 sampling switch coupled to a predetermined optical black  
7 value;

8               a third and fourth sampling switch; and

9               a sampling variable capacitor having a first and  
10 second end, the first and third sampling switches coupled to  
11 the first end of the sampling variable capacitor, the second  
12 and fourth switch coupled to the second end of the sampling  
13 variable capacitor.

1     34. (previously presented) The image processing  
2 apparatus as recited in claim 33, wherein the first and fourth  
3 sampling switch closes on the first phase of the control  
4 signal, wherein the second and third sampling switch closes on  
5 the second phase of the control signal.

1           35. (previously presented) The image processing  
2 apparatus as recited in claim 32, wherein the feedback circuit  
3 comprises a feedback capacitor.

1           36. (previously presented) An image processing method  
2 comprising the steps of:

3                 converting a signal of reflected light off of an  
4 object photoelectrically to obtain an optical black signal;

5                 generating a predetermined reference voltage;

6                 clamping the optical black signal to a predetermined  
7 reference voltage;

8                 amplifying the optical black signal by a first gain  
9 of a first programmable gain amplifier;

10                 amplifying the optical black signal by a second gain  
11 of a second programmable gain amplifier;

12                 feeding back the amplified signal to a reverse  
13 programmable gain amplifier;

14                 amplifying the optical black signal by the inverse  
15 of the second gain; and

16                 adding the amplified optical black signal to the  
17 optical black signal after the first programmable gain  
18 amplifier.

**Amendments to the Drawings:**

The attached sheet of drawings includes changes to Figure 1.

5 This sheet which includes Figure 1 replaces the original sheet  
including Figure 1.

Attachment:      Replacement Sheet

10                  Annotated Sheet Showing Changes